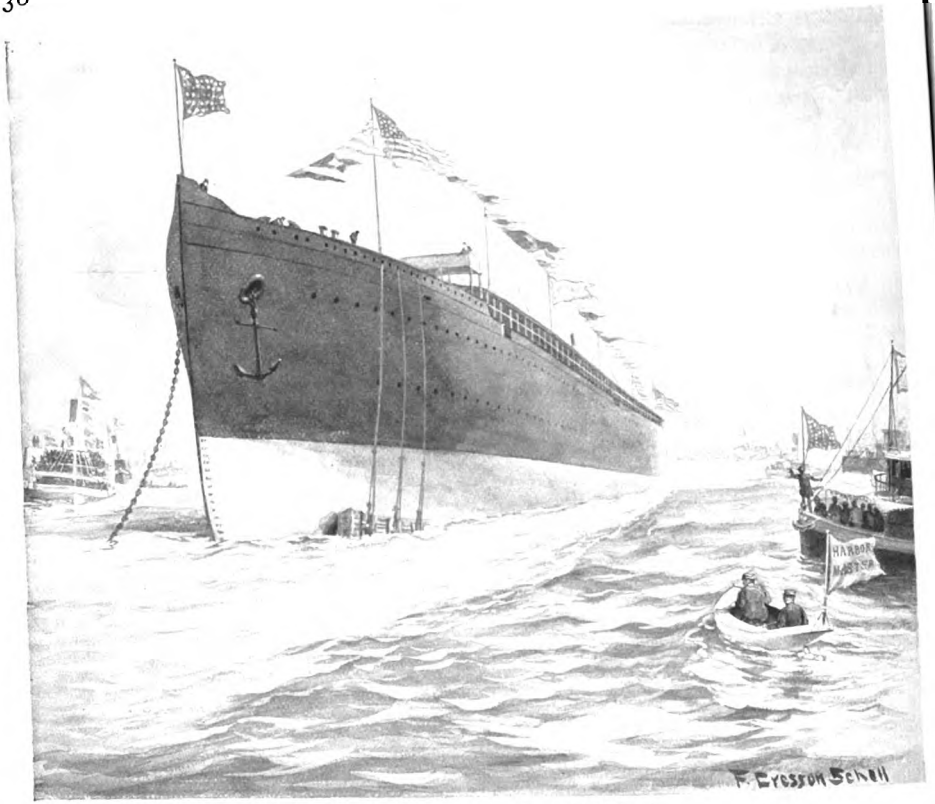


FREE FROM THE WAYS AT LAST! (SEE PAGE 40.)

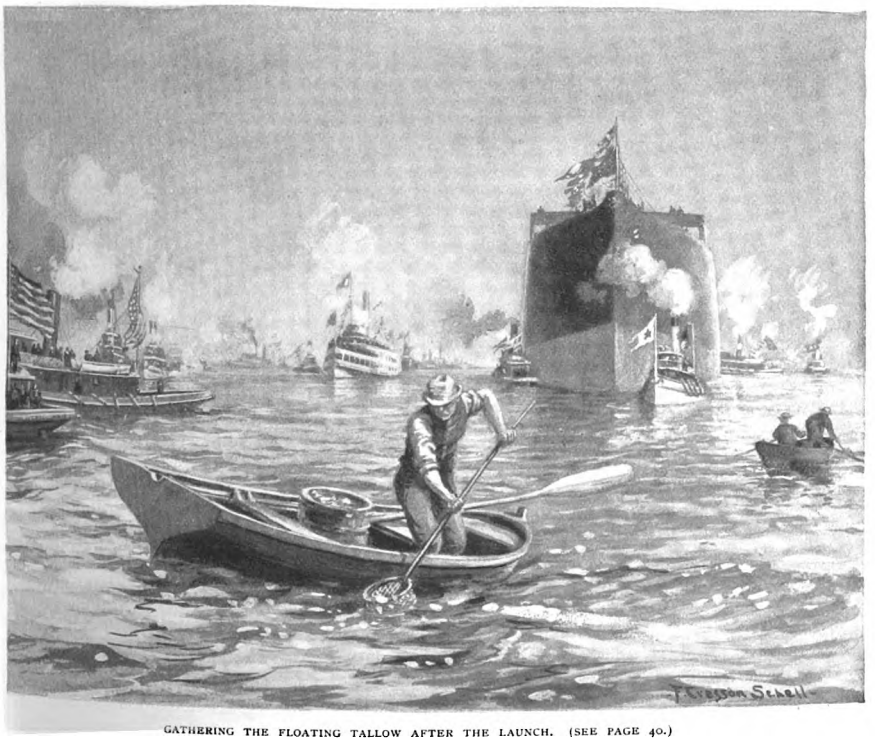
by the nose, and let her glide into the water. You must have the wine to christen her, and a crowd to cheer her, and some tugs to catch her and bring her back to her pier; but all these are mere details, and it would seem as if any ship could almost launch herself if she had half a chance.

A launch is simply taking a ship from the side of a stream down to the bank, and dropping her in the water where she belongs. This involves the task of lifting a mass of iron, in a ship like the "St. Louis," of about seven thousand tons, and the work of lowering it carefully for a distance of from twenty to forty feet. All this has to be done in the space of about thirty seconds, during which the vessel moves nearly six hundred feet. At once you can see that this is an enormous task. It involves the greatest responsibility in a short time that the shipbuilder meets. There is no opportunity to correct errors. Every mechanical appliance must work to perfection, and the manual details must be as nicely adjusted as the parts of a watch. You can launch a vessel as you can build one, on the rule-of-thumb or the hit-or-miss plan, and you may not come to grief; but it is best to put all these things in charge of that master spirit called Science, which has done so much for our physical advancement in this world, for then you know that it will be done properly.

It has often been said that man begins to die the moment that he begins to live. It might also be said that a ship begins to be launched the moment she begins to be built. The first thing in the actual construction is to arrange the keel-blocks on which the ship is to rest while she is building. They must be placed at certain distances apart, and each must be a little higher

than its neighbor nearer the water. These blocks are usually of the stoutest oak, and are placed from two to three feet apart. They must have a regular inclination, or the ship cannot be launched. In vessels like the St. Louis the incline is about one half an inch in height to a foot in length. In smaller vessels it is often more than one inch to the foot. Larger vessels have so much weight that a sharp incline is not as necessary as with smaller ones. The keel of the ship is laid on these blocks, and as fast as the sides of the vessel are built up great props are placed against them to make sure that by no accident will the vessel topple over.

At length the hull of the ship is completed. Then it is that the launching apparatus is prepared. This consists of two parts, one that remains fixed on the ground and one that glides into the water with the ship. The part that goes into the water is the cradle. It is that part in which the hull of the vessel rests snugly, and probably that is why it is called a cradle. When the time comes for the launch, a long row of blocks is built under each side of the ship at an equal distance from the keel-blocks, and of the same inclination. On these blocks rest first the stationary "ways." These consist of broad planks of oak from three to four feet wide, capable of sustaining a weight of from two to two and one half tons to the square foot. On top of these ways are the "sliding ways," of nearly the same breadth, and between the two the tallow is placed. A narrow cleat runs along the edge of the stationary ways so that the sliding ways shall not slip off as they carry the ship along. Above the sliding ways is what is called the "packing." This consists of pieces of timber packed close against the curving sides of the vessel to hold it firm to the sliding ways beneath. The curves in the hull vary so much that it would be impossible to fit the sliding ways to them, and so, by means of packing,



GATHERING THE FLOATING TALLOW AFTER THE LAUNCH. (SEE PAGE 40.)

the ship is fitted to the ways instead. The packing and the sliding ways constitute the cradle, and it is fastened to the ship by stout ropes. Along its length, at intervals of about eighteen inches, are big wedges, the points of which are inserted between the sliding ways and the packing. A rope about the thickness of a clothes-line runs from wedge to wedge, so that none may be lost when they float into the water.

We are now ready for the launch. Tallow to the thickness of about an inch has been spread between the ways as they were put in

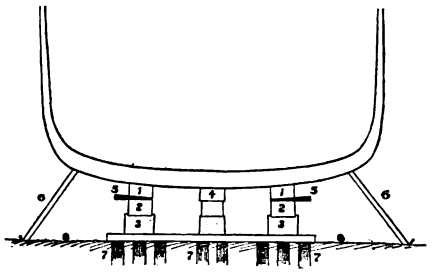


DIAGRAM SHOWING WHAT THE SHIP RESTS UPON.

1. The Packing.
2. The Sliding Ways.
3. The Stationary Ways.
4. The Keel-block.
5. Wedges.
6. The Props.
7. Piling.
8. Level of the Ground.

position, nearly sixty barrels being necessary for a ship like the St. Louis. The cradle sets snugly against the ship's bottom. The vessel, however, is still resting on the keel-blocks. The task now is to transfer the ship from these keel-blocks to the launching supports, and to take away the keel-blocks. Then, when the weight of the ship rests on the launching ways alone, all that is necessary is to saw away the "sole-piece" at the bow, where the stationary and sliding ways are fastened together, and the ship by her own weight will probably slide into the water. If she needs a start, several "jacks" using hydraulic power are ready beneath the keel to lift her a trifle and give her a push.

All the props have been taken down except a few that reach only a little way up the sides. A platform with a railing, on which the stalwart workmen may rest the stout pieces of timber they use as battering-rams when they are driving home the wedges, has been erected along the sides of the ship. There are nearly six hundred workmen distributed along the sides, in gangs of four each. Each gang has five wedges to look after. The time set for the launch is usually just before high water, where the stream has a tide. A dredge has been used directly in the path the vessel will take when she makes her plunge, so that she may strike no obstructions. Every part of the ways has been inspected. If the weather is cold, lard-oil has been mingled with the tallow to make it soft; and if the weather is warm, stearine has been mixed with it to make it hard.

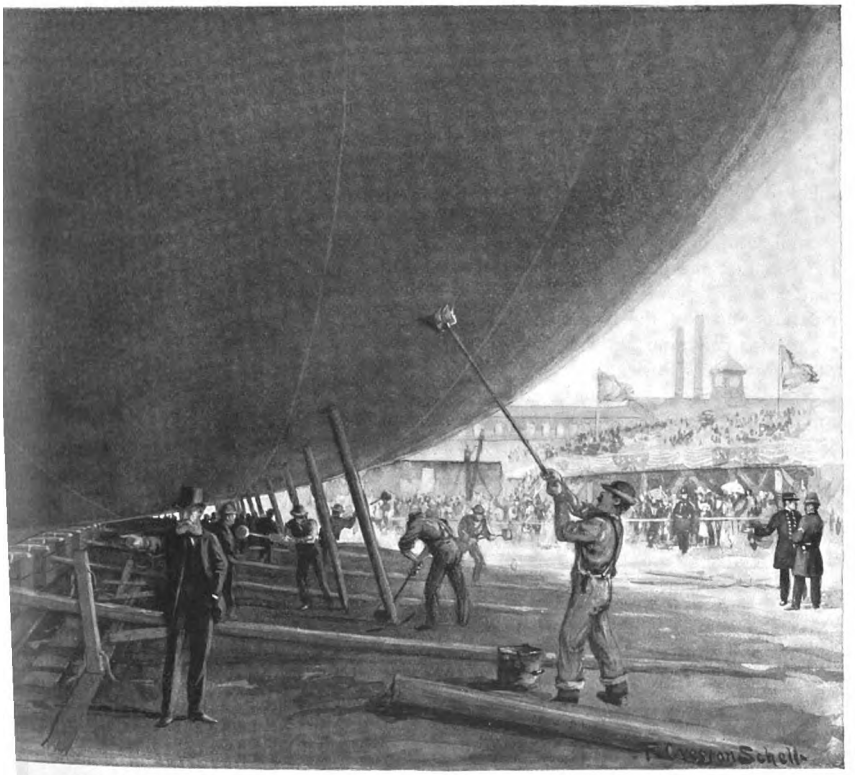
It is about an hour before the time for the ship to move. The workmen are summoned and the signal is given for the first "rally." All at once a great din arises. It is as if an army of street-pavers were at work beneath the ship. If you peer through the crowd you will see the men drawing back the battering-rams and then projecting them sharply against wedge after wedge. This work continues for four or five minutes, and then an inspection is made. It is necessary that the wedges be driven in uniformly. The effect of this rally seems imperceptible. It has resulted, however, in driving the packing close up against the sides of the ship, and, when that was accomplished, has driven the sliding ways down hard upon the stationary ways, squeezing out the tallow here and there. But the ship still rests upon the keel-blocks.

After a rest of fifteen or twenty minutes a second rally comes. This is more spirited than the first. In go the wedges, and the great hull seems to tremble just the least bit. She is beginning to rest on the launching ways. At last she is raised the smallest fraction of an inch above the keel-blocks. Now comes the time for quick work. Here is where the "pioneers" begin to swing their axes. One gang of men rushes up to the few props that are still resting against the sides of the hull. Quick blows are given, timbers and chips begin to fly, and prop after prop falls to the ground. Another gang of men is rushing after the pioneers. They are the painters, and with long brushes on the ends of poles, they daub over the places where the props rested, which could not be painted until the props were taken away.

Underneath the ship another gang of men is making havoc with the keel-blocks. Sharp chisels are being inserted on the sides of the

cks, and sledges are used as the workmen ne up from the river toward the bow, ocking this way and that the blocks which e been the support of the ship ever since was first laid down. At last, apparently r much confusion but really in accordance h a careful system, all the keel-blocks are ocked away, and the supreme moment has wrecked as she goes sliding down toward the water. She is held entirely by the stout piece of timber that clamps the stationary and sliding ways together just underneath the bow.

The christening party is standing on a platform under the bow, and just about where the water-line begins. The word to saw away the sole-piece has been given. A stillness



"THE PAINTERS, WITH LONG BRUSHES, DAUB OVER THE PLACES WHERE THE PROPS RESTED."

ed. All the wedges have been driven ; and their outer edges are in a line as ht as a file of soldiers on dress parade. ship rests on an entirely new foundation a very treacherous one. There are no upports to keep her from toppling over. oboggan slides are ready for work, and must be true in their inclination and in horizontal position, or the ship will be comes upon the throng, and the zip, zip, zip of the big saws on each side of the ship is heard distinctly more than fifty yards away. The young woman who is to name the vessel has placed one hand against the bow to feel the first tremor of life, and in the other she holds the decorated bottle of champagne, enmeshed in a silk web, ready to strike the bottle against the bow.

The vessel shakes along her entire length; there comes a crash; she breaks away before the saws have cut her loose; a terrific din arises; the christening words are spoken but not heard; and the stately ship begins to glide down the ways apparently without effort, and with the ease of a ship coming up a bay under half speed. She strikes the water, kicks up a big wave that goes rolling across the stream, and then drops at the bow into the water. The tide catches her in its arms, and tries to run away with her, but the men on board drop the anchors into the water, and the tugs that have been lying near by catch hold of her, and in a few minutes she is led captive to her dock, ever after that to obey the master mind that shall guide her over the sea.

That a launch is a matter of mathematics, as well as of great skill and labor, is shown by the fact that the man of science who has the matter in charge always makes a set of calculations showing the strain on the ship and its precise condition at practically every foot of the journey down the ways. If a boat should get in the way, or if it should take an unusual length of time to knock out the keel-blocks, or if any one of half a dozen things should cause serious delay, the scientific man knows just how long he can wait, and just how far the limit of safety extends.

There is always one supreme moment in a launch, and it is at a time that escapes the average spectator. It is when the vessel gets fairly well into the water. This is when an important factor known as the "moment of buoyancy" comes into play. If you can imagine a vessel sliding down an incline without any water into which to drop, you can see that the vessel would tip down suddenly at the end which has left the ways, and would rise at the end still on the incline. But really, in successful launches, the stern of the vessel is gradually lifted up by the water, and this throws the weight forward on that part of the ship still resting on the ways. The force of the water is called the "moment of buoyancy," and the natural tendency of the ship to drop to the bottom of the stream is called the "moment of weight." Now the moment of buoyancy must always be greater than the moment of weight; but it must not be very much greater, for if it were it would throw too much weight forward on the part of the ship still on the ways, and might break them down, or injure the plates or keel of the ship. When the great English battle-ship "Ramillies" was launched, this did really happen; and so great was the strain near the bow that parts of the cradle were actually pushed right into the bottom of the vessel. It is this danger of disaster that causes the scientific launcher to make the most careful calculations as to the conditions surrounding the ship at every foot of her journey into the water.

In this country most of the launches on the seaboard are made stern foremost. Sometimes, however, a ship is launched bow on. Along the great lakes the usual custom is to launch ships sidewise. On the great Clyde, in Scotland, they are launched obliquely into the river because it is so narrow. Had any of the large ships which have been built there in recent years been launched at right angles to the stream, one end of the ship would have stuck in the bank on the other side before the vessel had entirely left the ways. Where side launches are used, there are eight or ten ways made instead of two, and when the ship reaches the end of the incline she simply drops into the stream along her entire length. Sometimes it is necessary to check a vessel in a very short distance after launching. This is done by a series of drags, or flying cables, which are set in motion on the ground beside the ship, each one coming into play at regular intervals as she goes down the incline, and each helping to hold back the ship until she is under complete control the moment she reaches the water.

When the ship is finally clear, and the hurrahing is over, the workmen clamber on the ways and even go out in small boats to gather up the tallow for use on another occasion.

The crowd now begin to go home. They have seen the ship "put overboard." Few of them, however, have seen the most interesting part of the work — that which goes on underneath the ship. It is there that the hard work is done, but it would not do to allow the spectators to come near the workmen. These men must work briskly, and must be able to attend to their duties without interference of any kind.